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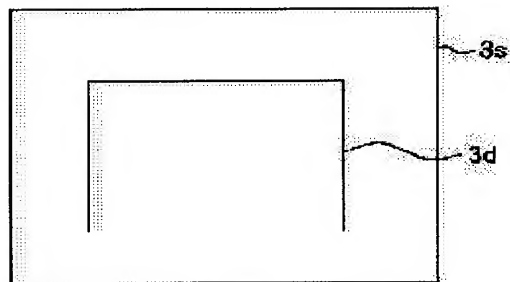
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(21)Application number : **2000-327096**(71)Applicant : **CANON INC**(22)Date of filing : **26.10.2000**(72)Inventor : **HOSHI KOJI****(54) CAMERA****(57)Abstract:**

PROBLEM TO BE SOLVED: To eliminate unbalance of the peripheral amount of light of a motion picture when a shake prevention by shifting is performed.

SOLUTION: In the camera picks up the motion picture and a still picture by commonly using an image pickup optical system 1 and an image pickup element 3, when an optical element 2 as a part of the image pickup optical system is shifted to correct the shake in the orthogonal direction of an optical axis, an image size 3d picked up by the image pickup element during picking up the motion picture is made smaller than an image size 3s during picking up the still picture.



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CLAIMS

[Claim(s)]

[Claim 1]It is a camera which performs animation photography and static image photographing using a common photographing optical system and an image sensor, A camera making smaller than an image size at the time of static image photographing an image size photoed with said image sensor at the time of animation photography when displacing an optical element which constitutes said a part of photographing optical system to optic-axis direction crossing at a right angle and performing shake compensating.

[Claim 2]The camera according to claim 1 setting up more greatly than the f number of the maximum diaphragm at the time of animation photography the f number of the maximum diaphragm at the time of static image photographing when a focal distance of said photographing optical system is the same.

[Claim 3]The camera according to claim 2 which said photographing optical system is a camera of variable focus distance, and is characterized by setting up more greatly than the f number of the maximum diaphragm at the time of animation photography the f number of the maximum diaphragm at the time of static image photographing in at least some focal distances among variable ranges of a focal distance.

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DETAILED DESCRIPTION

[Detailed Description of the Invention]

[0001]

[Field of the Invention]This invention relates to the camera which has what is called a vibration proof function further about the camera in which the both sides of animation photography and static image photographing are possible.

[0002]

[Description of the Prior Art]As a camera in which the both sides of animation photography and static image photographing are possible, while having a CCD image sensor in animation photography, the camera which can load with a silver halide film is used for static image photographing.

[0003]It comprises this camera so that taking-lens light flux may be divided in an optical path, image formation of one luminous flux splitting may be further carried out on a CCD image sensor through a reduction optical system and image formation of another luminous flux splitting may be carried out to the silver halide film of a big screen from CCD. In such a camera, the high-definition photography unique to a silver salt is possible in animation photography being not only possible but static image photographing.

[0004]A common taking lens and CCD image sensor, and the video camera are proposed by animation photography and static image photographing as a camera in which the both sides of animation photography and static image photographing are possible.

[0005]The above cameras have many things with a vibration proof function to which made it make optic-axis direction crossing at a right angle carry out shift displacement of some lenses which constitute a taking lens, in order to amend the image shake what is called by a shaking hand.

[0006]

[Problem(s) to be Solved by the Invention]However, in the camera which uses a CCD image sensor and a silver halide film properly, and performs animation photography and static image photographing, as mentioned above, since the luminous flux division means is required, there is a problem that a camera is enlarged.

[0007]The high-definition still picture picture which is the grade of considering it as a still picture picture, and can be satisfied with animation photography and static image photographing of one picture of the inside which continues in predetermined time at the time of animation photography, and is photoed in a common taking lens and the video camera using a CCD image sensor enough cannot be acquired.

[0008]In order to acquire a high definition still picture picture, if it enables it to perform aberration compensation of a lens to fitness more, it will be easy to enlarge a lens system and by extension, the whole camera. When the pixel number of CCD is only increased, the superfluous number of high pixels above the level demanded at the time of animation photography will be used, and an animation processing circuit will be asked for an excessive burden.

[0009]In the camera provided with the vibration proof function mentioned above, if optic-axis direction crossing at a right angle is made to carry out shift displacement of some lenses which constitute a taking lens at the time of vibration proof, dynamic imbalance will arise in the light volume of a periphery among the light flux which reaches an image sensor. And especially the imbalance of this amount of ambient light has a possibility of becoming what is conspicuous at the time of animation photography.

[0010]Then, an object of this invention is to provide the camera which enabled it to perform high-definition static image photographing while enabling it to prevent change of the light volume

balance accompanying the vibration proof at the time of animation photography, though it is small.

[0011]

[Means for Solving the Problem] In a camera which uses a common photographing optical system and an image sensor, and performs animation photography and static image photographing in this invention in order to attain the above-mentioned purpose, When displacing an optical element which constitutes a part of photographing optical system to optic-axis direction crossing at a right angle and performing shake compensating, it is made to make smaller than an image size at the time of static image photographing an image size photoed with an image sensor at the time of animation photography.

[0012] An image size photoed at the time of vibration proof by namely, a thing for which a direction at the time of animation photography is made smaller than the time of static image photographing. It becomes possible to perform animation photography in image pick-up area inside a periphery which light volume imbalance tends to produce with vibration proof, and it becomes possible to make imbalance of the amount of ambient light not conspicuous at the time of animation photography. Therefore, it becomes possible to perform vibration proof sufficient also by animation photography, without making a photographing optical system large-sized.

[0013] Since static image photographing photos a moment, and imbalanced tolerance level of the amount of ambient light is wider than animation photography from the first, even if it enlarges an image size, imbalance of the amount of ambient light produced at the time of vibration proof is not conspicuous.

[0014] And it is also possible to be able to make a pixel number at the time of static image photographing more than the time of animation photography, and to raise image quality of a still picture picture by enlarging an image size of static image photographing, when using an image sensor which has an iterative array of minute light-receiving pixels, such as CCD and CMOS.

[0015] By setting up more greatly than the f number of the maximum diaphragm at the time of animation photography the f number of the maximum diaphragm at the time of static image photographing, when a focal distance of a photographing optical system is the same, It also becomes possible to improve imbalance of the amount of ambient light at the time of vibration proof when taking a photograph by the maximum diaphragm at the time of static image photographing.

[0016]

[Embodiment of the Invention] The composition of the camera which is an embodiment of this invention is shown in drawing 1. The sectional view and aberration figure of the numerical example of the taking lens which are used for the above-mentioned camera are shown in drawing 2, drawing 3, and drawing 4. In the above-mentioned camera, the relation between the focal distance of a taking lens and Fno. of the maximum diaphragm set up for every focal distance is shown in drawing 5. The image size of the taking lens in the above-mentioned camera is shown in drawing 6, and the frequency characteristic of the performance by Fno. of the ideal lens of non-aberration is shown in drawing 7. The flow chart showing the operating sequence of the above-mentioned camera is shown in drawing 8.

[0017] In drawing 1, 1 is a zoom taking-lens system (photographing optical system), and 2 is some lenses which constitute the taking-lens system 1, and is a shake compensating lens which makes vibration-proof by being displaced to optic-axis direction crossing at a right angle (what is called hand shake correction).

[0018] 3 is an image sensor and solid state image pickup devices, such as CCD or CMOS whose cell pitch (pixel arrangement pitch) is about 3 microns, are used.

[0019] 4 is a mode transfer switch for switching animation photography (animation mode) and static image photographing (still picture mode). In the camera of this embodiment, both animation photography and static image photographing are performed using the common taking-lens system 1 and the image sensor 3, For example, it records on recording media, such as videotape whose moving image information is not illustrated, and DVD, and still picture information is recorded on recording media, such as a stick shape or compact memory device and DVD.

[0020] 9 is a camera control circuit which manages control of the whole operation of this camera, and 5 is a zoom control circuit which performs zooming drive control of the taking-lens system 1 according to the command signal from the camera control circuit 9.

[0021] 6 is a vibration-proof control circuit which performs shift drive controlling of the shake compensating lens 2 according to the command signal from the camera control circuit 9, and 7 is a throttling control circuit which extracts according to the command signal from the camera

control circuit 9, and performs SP's drive controlling. In this embodiment, predetermined Fno. is obtained by diaphragm SP's control.

[0022]8 is an image pick-up area control circuit which embraces the command signal from the camera control circuit 9, and performs switching control of the image pick-up area (image size) on the image sensor 3.

[0023]Next, according to the flow chart of drawing 8, operation of this camera (mainly camera control circuit 9) is explained. First, if are one [an unillustrated main switch], a power supply is switched on and this flow starts, at Step (by a diagram, it abbreviates to S) 1, the state of the mode transfer switch 4 will be detected and a camera will distinguish animation mode or still picture mode.

[0024]When it is animation mode, it progresses to Step 2 and an image size is set up acquire a picture from the range of the animation image pick-up area (for example, phi 3.9 or 2.34 mm x 3.12 mm) 3d of the image sensor 3 shown in drawing 6 through the image pick-up area control circuit 8.

[0025]At Step 3, the variable range of the focal distance of the taking-lens system 1 in animation mode is continuously set as the total range of a tele terminal from fw-ft, i.e., a wide end.

[0026]At Step 4, it sets up continuously control Fno. of the maximum diaphragm to the focal distance in animation mode on the diaphragm curve d at the time of the animation shown in drawing 5. According to this embodiment, Fno. of the maximum diaphragm in animation mode will change in 1.65-2.2 according to a focal distance.

[0027]In Step 5, Fno. of the minimum diaphragm in animation mode is set as the minimum diaphragm (for example, F11) at the time of an animation.

[0028]In this way, diaphragm SP in animation mode is controlled by Step 6 between Fno. of the minimum diaphragm set to Fno. of the maximum diaphragm set up at Step 4 at Step 5.

[0029]And in Step 7, the optical vibration-proof control performed by shifting the shake compensating lens 2 to optic-axis direction crossing at a right angle using the information from the shake detection means (for example, it comprises a circuit which integrates with acceleration or a velocity sensor, and a sensor output) provided in the taking lens or the camera body is started.

[0030]Next, when camera deflection distinguishes whether it is being unable to amend only in the shift of the above-mentioned shake compensating lens 2 (shake compensating is insufficient) and cannot amend in animation mode in Step 8, What is called electronic vibration proof control that shifts the animation image pick-up area mentioned above out of the larger area (for example, a maximum of 3.06 mm x 4.08 mm) on the image sensor 3, and starts it is performed.

[0031]On the other hand, in Step 1, in being still picture photographing mode, It progresses to Step 10 and a bigger (there are many pixel numbers) image size than the time of animation photography is set up acquire a picture from the still picture image pick-up area (for example, phi 5.1 or 3.06 mm x 4.08 mm) on the image sensor 3.

[0032]Next, in Step 11, the variable range of the focal distance in still picture mode is restricted to the range of a tele terminal from the position which approached the tele terminal side from the range of fsw-ft, i.e., the wide end at the time of animation photography. It stops thereby, being able to carry out zoom to the range of fw-fsw by the side of the wide angle end which was able to stand it still in zoom at the time of animation photography at the time of photography.

[0033]For this reason, the influence of the still picture picture on residual aberrations, such as the big distortion of the taking-lens system 1 or coma aberration, and the chromatic aberration of magnification, can be removed by the wide angle end side. Therefore, without enlarging the taking-lens system 1, after securing a to some extent required variable power rate (fsw-ft), improvement in image quality of a still picture picture can be aimed at.

[0034]It sets up in Step 12 control Fno. of the maximum diaphragm to the focal distance in still picture mode on the diaphragm curve s at the time of the still picture shown in drawing 5.

According to this embodiment, Fno. of the maximum diaphragm in still picture mode will change in 1.83-2.88 according to a focal distance.

[0035]That is, in this embodiment, in the range of focal distance fsw-ft in the time of animation photography and static image photographing. It is set up to the same focal distance at the time of static image photographing so that open Fno. may become dark rather than the time of animation photography, so that the direction at the time of static image photographing may become large in Fno. of the maximum diaphragm when a focal distance is the same. Furthermore the direction at the time of static image photographing is set up so that open Fno. may become

darker, especially in this embodiment, from the time of animation photography to the looking-far side in Step 13. Fno. of the minimum diaphragm in still picture mode is set as the minimum diaphragm (for example, F8) at the time of a still picture brighter than animation photographing mode. That is, it prevents from narrowing down in still picture mode to Fno. (for example, F11) which can be narrowed down at the time of animation mode.

[0036]Here, in F8 - 11, the degradation by the physical optics factor of diffraction phenomena becomes large by enlarging the f number rather than the improved efficiency by the geometric optics aberration reduction factor of the optical resolution performance near an axis top. For this reason, it has set up so that the f number of the minimum diaphragm at the time of static image photographing may become smaller than the f number of the minimum diaphragm at the time of animation photography in this range.

[0037]In this way, in Step 14, diaphragm SP in still picture mode is controlled by this embodiment between Fno. of the minimum diaphragm set to Fno. of the maximum diaphragm set up at Step 12 at Step 13.

[0038]Here, although throttling control is performed between the above-mentioned maximum diaphragm and the minimum diaphragm in still picture mode in the above-mentioned step 14, in order to compensate the light volume regulation by diaphragm at this time, it is desirable to compensate deficiency of light quantity with a low speed shutter or a stroboscope (not shown) to a low-intensity photographic subject.

[0039]moreover — receiving a high luminance object in connection with having set up smaller (bright) than the minimum diaphragm at the time of animation photography the minimum diaphragm at the time of static image photographing — light volume — in order to avoid becoming exaggerated, it is desirable to correspond by the high-speed electronic shutter by the side of the picture element 3 or the high speed shutter within the taking-lens system 1.

[0040]And in Step 15, the same optical vibration-proof control as Step 7 mentioned above is started.

[0041]Since according to this embodiment it is set up to the same focal distance of the taking-lens system 1 at the time of static image photographing to have explained above so that an open F number may become dark rather than the time of animation photography, While bright animation photography can be performed, the optical performance fall by the spherical aberration of a photographing optical system, the chromatic aberration, an assembly eccentric error, etc. can be suppressed at the time of static image photographing. Therefore, in the small taking-lens system 1, aberration etc. can be amended good, and the camera in which the animation photography with it and high-definition static image photographing are possible can be realized.

[a light and burden of animation processing and] [bright]

[0042]Although the case where Fno. of the maximum diaphragm was controlled by this embodiment to become the characteristic which differs thoroughly by animation photography and static image photographing (both curves do not cross) like the curve d shown in drawing 5 and the curve s was explained, It is important especially in order that setting up smaller than Fno. of the maximum diaphragm at the time of static image photographing Fno. of the maximum diaphragm at the time of animation photography in the state of the focal distance f_t may make image quality performance of a still picture good. For this reason, it may be made for Fno. of the maximum diaphragm at the time of animation photography to use curvilinear d' which is in agreement with Fno. of the maximum diaphragm at the time of static image photographing in the state of the focal distance f_{sw} at the time of animation photography.

[0043]Although the pixel number at the time of static image photographing is increased compared with the time of animation photography and this is attaining high definition-ization of the still picture picture in this embodiment by making the image size at the time of the static image photographing on the image sensor 3 larger than the image size at the time of animation photography, In this case, by performing control which makes dark the open F number at the time of the static image photographing mentioned above, without making the taking-lens system 1 enlarge, it becomes possible to amend the circumference aberration of a still picture good, and higher-definition static image photographing can be performed.

[0044]Fno. of the minimum diaphragm at the time of static image photographing and animation photography in this embodiment, Among the variable ranges of diaphragm SP's Fno., the range of about F= eight to 11 diaphragm region, In namely, the range to which the degradation by the physical optics factor of diffraction phenomena becomes large by enlarging Fno. rather than the improved efficiency by the geometric optics aberration reduction factor of the optical resolution performance near an axis top. It has set up so that Fno. (F= 8) of the minimum diaphragm at the

time of static image photographing may become smaller than F_{no} . ($F=11$) of the minimum diaphragm at the time of animation photography. Thereby, image quality at the time of static image photographing can be made more into fitness compared with the image quality at the time of animation photography.

[0045] This is concretely explained using drawing 7. Drawing 7 shows the frequency characteristic of the contrast by F_{no} of a non-aberration ideal lens, and means how the optical performance of the taking-lens system 1 changes with F_{no} .

[0046] In this figure, if F_{no} is extracted to $F8$, contrast will fall to 50% mostly by an equivalent for 80 which is the frequency of the half of the nyquist space line pair frequency of 3-micron pitch CCD. Since contrast will fall more if the actual taking-lens system 1 which has aberration from the first is used, in order to obtain a high-definition still picture, it is controlling by this embodiment not to use a small diaphragm from $F8$ at the time of a still picture.

[0047] Here, if $F_{smin}=8$, $\lambda=0.588$, and $P=3$ are substituted for the central paragraph of a conditional expression (1), it will be set to $F_{smin}\lambda/P=1.57$ and the relation of a conditional expression (1) will be filled.

[0048] In the above-mentioned formula (1), when a lower limit is set to 0.4 and further 0.8, the possible range of light volume adjustment is expanded, and it is desirable. When upper limit is carried out like 3.3 or 2.2, it is good by stopping the degradation by diffraction phenomena.

[0049] In this embodiment, the image size at the time of the animation photography in the case of performing vibration-proof control is made smaller than the image size at the time of the static image photographing in the case of similarly performing vibration-proof control. Since it is made to perform animation photography in the image pick-up area inside the periphery which light volume imbalance tends to produce with vibration proof, imbalance of the amount of ambient light accompanying the vibration proof at the time of animation photography can be made not conspicuous. Therefore, vibration proof sufficient also by animation photography can be performed, without making the taking-lens system 1 large-sized.

[0050] In the static image photographing which photos a moment, since the imbalanced tolerance level of the amount of ambient light is wider than animation photography from the first, even if it enlarges an image size, the imbalance of the amount of ambient light produced at the time of vibration proof is not conspicuous.

[0051] Since F_{no} of the maximum diaphragm at the time of static image photographing is set up more greatly than F_{no} of the maximum diaphragm at the time of animation photography when the focal distance of the taking-lens system 1 is the same, The imbalance of the amount of ambient light at the time of vibration proof when taking a photograph by the maximum diaphragm at the time of static image photographing is also improvable.

[0052] Although the above-mentioned embodiment explained the case where the f number of the maximum diaphragm at the time of the static image photographing in the state where a focal distance is the same was set up more greatly than the f number of the maximum diaphragm at the time of animation photography, in a part of range $f_{sw}-f_t$ among all the variable range f_w-f_t of a focal distance, It may be made to set up more greatly than the f number of the maximum diaphragm at the time of animation photography the f number of the maximum diaphragm at the time of the static image photographing in the state where a focal distance is the same, in all the variable range f_w-f_t of a focal distance.

[0053] Although the above-mentioned embodiment explained the case where a variable focus distance type taking-lens system was used, this invention can be applied also when using a single focus distance type taking-lens system.

[0054] The numerical example of the photographing optical system used for the camera of this invention is shown in a (numerical example), next Table 1.

[0055] As shown in drawing 2, here a photographing optical system The 1st group lens L1 of the object side to immobilization, the 2nd group lens L2 as BARIETA, diaphragm SP, The glass blocks G, such as the 4th group lens L4 and faceplate as the 3rd group lens (shake compensating lens) L3, flare stopper FS, and a focus lens compensator, and a filter, are the zoom lenses of 4 group rear focus method which has been arranged in order and constituted.

[0056] The solid line 4a shown in the figure under the 4th group lens L4, The moving track of the 4th group lens L4 for amending the image surface fluctuation accompanying the variable power from a wide angle end when carrying out the focus to the infinite distance object to a tele edge is shown, The dotted line 4b shows the moving track of the 4th group lens L4 for amending the image surface fluctuation accompanying the variable power from a wide angle end when carrying out the focus to the short distance object to a tele edge.

[0057]The optical sectional view in the focal distance fw (wide angle end at the time of animation photography), fsw (wide angle end at the time of static image photographing), fm (middle), and ft (tele edge) of a photographing optical system is shown in drawing 2 sequentially from the top. The aberration figure in each above-mentioned focal distance is shown in drawing 3 and drawing 4.

[0058]in Table 1 — ri — the object side — order — it is a curvature radius of the i-th field, and, as for di, the interval (air reduced property) of the i-th field and the field of eye watch (i+1), nickel, and nui (in a table, it is described as vi) are the refractive index and Abbe number of glass of the i-th optical member in order from the object side in the object side, respectively.

[0059]When 14th aspherical surface shape is made into the X-axis in an optical axis direction, and makes positive the direction of movement of H axis and light in optic-axis direction crossing at a right angle and a paraxial curvature radius and each aspheric surface coefficient are set to K, A, B, C, D, and E for R, [0060]

[Equation 1]

$$X = \frac{(1/R)Y^2}{1 + \sqrt{1 - (1+K)(Y/R)^2}} - AH^2 + AY^2 + BY^4 + CY^6 + DY^8$$

[0061]It expresses with the becoming formula. The display of "e-Z" means "10^{-Z}", for example.

[0062]

[Table 1]

f = 4.32 ~ 42.02		FNo=1: 1.65 ~		2ω=48.6° ~	
r 1=	46.054	d 1=	1.40	n 1=1.84666	v 1=23.9
r 2=	25.429	d 2=	6.96	n 2=1.48749	v 2=70.2
r 3=	-171.864	d 3=	0.20		
r 4=	21.420	d 4=	3.55	n 3=1.77250	v 3=49.6
r 5=	56.119	d 5=	可変		
r 6=	62.351	d 6=	0.60	n 4=1.84666	v 4=23.9
r 7=	5.292	d 7=	2.81		
r 8=	-14.229	d 8=	0.50	n 5=1.78590	v 5=44.2
r 9=	137.803	d 9=	0.20		
r10=	11.940	d10=	2.74	n 6=1.84666	v 6=23.9
r11=	-11.940	d11=	0.50	n 7=1.60211	v 7=60.6
r12=	19.615	d12=	可変		
r13=	∞ (絞り)	d13=	3.30		
r14=	12.798 (非球面)	d14=	1.89	n 8=1.80010	v 8=40.7
r15=	99.912	d15=	3.83		
r16=	22.767	d16=	0.50	n 9=1.84666	v 9=23.9
r17=	7.926	d17=	2.70	n10=1.48749	v10=70.2
r18=	-23.906	d18=	1.01		
r19=	∞	d19=	可変		
r20=	13.355	d20=	2.68	n11=1.78590	v11=44.2
r21=	-13.355	d21=	0.50	n12=1.84666	v12=23.9
r22=	176.611	d22=	可変		
r23=	∞	d23=	3.60	n13=1.61633	v13=64.1
r24=	∞				

	fw	fsw	fm	ft
焦点距離	4.32	5.33	17.78	42.02
可変間隔				
d 5	0.84	3.67	15.02	19.75
d12	20.60	17.76	6.42	1.69
d19	3.44	2.91	1.12	4.12
d22	3.49	4.82	5.81	2.81

非球面係数

第14面	K	A	B	C	D	E
	-7.8131e-01	0.0000e+00	-1.8842e-05	-2.8047e-07	1.5637e-08	-1.9706e-10

[0063]By taking the above rear focus methods compared with the case where let out the 1st group in what is called a 4 group zoom lens, and a focus is performed in a number value example, The increase of the lens effective diameter of the 1st group is prevented effectively, preventing the performance degradation by the eccentric error of the 1st group.

[0064]And when the direct front stirrup of the 3rd group stations diaphragm SP in the 3rd group, the aberration variation by a moving lens group was lessened, from diaphragm SP, the interval of the front lens group was shortened and the reduction of the 1st group lens diameter is attained easily.

[0065]

[Effect of the Invention][as explained above, when according to this invention displacing an optical element to optic-axis direction crossing at a right angle and performing shake compensating (vibration proof)], Since it is made to make smaller than the image size at the time of static image photographing the image size photoed with an image sensor at the time of animation photography, Animation photography can be performed in the image pick-up area inside the periphery which light volume imbalance tends to produce with vibration proof, and it can avoid being conspicuous in the imbalance of the amount of ambient light at the time of animation photography. Therefore, vibration proof sufficient also by animation photography can be performed, without making a photographing optical system large-sized.

[0066]And by enlarging the image size of static image photographing, when using the image sensor which has an iterative array of minute light-receiving pixels, such as CCD and CMOS, the pixel number at the time of static image photographing can be made more than the time of animation photography, and the image quality of a still picture picture can also be raised.

[0067]If the f number of the maximum diaphragm at the time of static image photographing is set up more greatly than the f number of the maximum diaphragm at the time of animation photography when the focal distance of a photographing optical system is the same, The imbalance of the amount of ambient light at the time of vibration proof when taking a photograph by the maximum diaphragm at the time of static image photographing is also improvable.

[Translation done.]

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DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]

[Drawing 1]It is a schematic diagram showing the composition of the camera which is an embodiment of this invention.

[Drawing 2]It is an optical sectional view of the numerical example of the taking lens used for the above-mentioned camera.

[Drawing 3]It is an aberration figure of the numerical example of the above-mentioned taking lens, and they are an aberration figure at the time of animation photography with the focal distance fw of the lens whole system, and an aberration figure at the time of the static image photographing in the focal distance fsw from a top.

[Drawing 4]It is an aberration figure of the numerical example of the above-mentioned taking lens, and they are an aberration figure at the time of animation photography with the focal distance fsw of the lens whole system, and an aberration figure at the time of the static image photographing in the focal distance ft from a top.

[Drawing 5]It is a figure showing the relation between the focal distance in the above-mentioned camera, and Fno. of the maximum diaphragm.

[Drawing 6]It is an explanatory view of the image size of the taking lens in the above-mentioned camera.

[Drawing 7]It is a frequency characteristic figure showing the performance by Fno. of a non-aberration ideal lens.

[Drawing 8]It is a flow chart which shows the operating sequence of the above-mentioned camera.

[Description of Notations]

- 1 Taking-lens system
- 2 Shake compensating lens
- 3 Image sensor
- 4 Mode transfer switch
- 5 Zoom control circuit
- 6 A vibration-proof control circuit
- 7 Throttling control circuit
- 8 Image pick-up area control circuit
- 9 Camera control circuit
- SP Diaphragm
- FS Flare stopper

[Translation done.]

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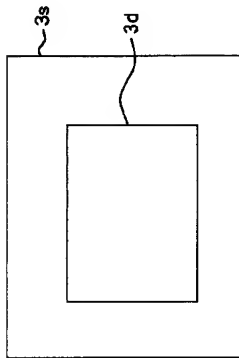
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(54) 【発明の名称】 カメラ

(57) 【要約】

【課題】 シフト防振時に動画像の周辺光量にアンバ
ランスが目立つ。

【解決手段】 動画撮影と静止面撮影とを共通の撮影光
学系1および撮像素子3を用いて行うカメラにおいて、
撮影光学系の一部を構成する光学素子2を光軸直交方向
に変位させて揺れ補正を行う際に、動画撮影時に撮像素
子により撮影するイメージサイズ3 dを、静止面撮影時
のイメージサイズ3 sよりも小さくする。



【特許請求の範囲】

【請求項1】 動画撮影と静止面撮影とを共通の撮影光
学系および撮像素子を用いて行うカメラであって、

前記撮影光学系の一部を構成する光学素子を光軸直交方
向に変位させて揺れ補正を行う際に、動画撮影時に前記
撮像素子により撮影するイメージサイズを、静止面撮影
時のイメージサイズよりも小さくすることを特徴とする
カメラ。

【請求項2】 前記撮影光学系の焦点距離が同じである
場合に、静止面撮影時における最大絞りのFナンバーを
動画撮影時における最大絞りのFナンバーよりも大きく
設定することを特徴とする請求項1に記載のカメラ。

【請求項3】 前記撮影光学系が可変焦点距離のカメラ
であり、

焦点距離の可変範囲のうち少なくとも一部の焦点距離に
おいて、静止面撮影時における最大絞りのFナンバーを
動画撮影時における最大絞りのFナンバーよりも大きく
設定することを特徴とする請求項2に記載のカメラ。

【発明の詳細な説明】

【0001】

【発明の属する技術分野】 本発明は、動画撮影と静止面
撮影の双方が可能なカメラに関し、さらにいわゆる防振
機能を有するカメラに関するものである。

【0002】

【従来の技術】 動画撮影と静止面撮影の双方が可能なカ
メラとして、動画撮影用にCCD撮像素子を有すると
ともに、静止面撮影用に磁気フィルムの装置が可能なカメ
ラが用いられている。

【0003】 このカメラでは、撮影レンズ光束を光路中
で分割し、一方の分割光束をさらに縮小光学系を通して
CCD撮像素子上に結像させ、もう一方の分割光束をC
CDより大画面の磁気フィルムに結像させるように構成
されている。このようなカメラでは、動画撮影が可能で
あるだけでなく、静止面撮影においては磁気ならではの
高画質撮影が可能である。

【0004】 また、動画撮影と静止面撮影の双方が可能
なカメラとして、動画撮影と静止面撮影とで共通の撮影
レンズとCCD撮像素子とビデオカメラが提案されてい
る。

【0005】 また、上記のようなカメラには、いわゆる
手振れによる補正を補正するために、撮影レンズを構
成する一部のレンズを光軸直交方向にシフト変位させる
ようにした防振機能付きのものが多い。

【0006】

【発明が解決しようとする課題】 しかしながら、CCD
撮像素子と磁気フィルムとを使い分けて動画撮影と静止
面撮影を行うカメラでは、上述したように光束分割手
段が必要であるためにカメラが大型化するという問題が
ある。

【0007】 また、動画撮影と静止面撮影で共通の撮影

レンズとCCD撮像素子を用いるビデオカメラでは、動
画撮影時に所定時間内に連続して撮影される中の1つの
画像を静止面画像とするという程度であり、十分満足で
きる高画質の静止面画像を得ることができない。

【0008】 なお、高画質な静止面画像を得るために、
レンズの収差補正をより良好に行えるようにするとレン
ズ系ひいてはカメラ全体が大型化し易い。また、黒にC
Dの画素数を多くすると、動画撮影時に要求される水
準以上の適切な高画素数を有することになり、動画処理
回路に過大な負荷を求めることになる。

【0009】 さらに、上述した防振機能を備えたカメラ
において、防振時に撮影レンズを構成する一部のレンズ
を光軸直交方向にシフト変位させると、撮像素子に到達
する光束のうち周辺部の光量に動的なアンバランスが生
じる。そして、この周辺部の光量に動的なアンバランスが
動画撮影時に目立つものとなるおそれがある。

【0010】 そこで本発明は、小型でありながら、動画
撮影時における防振に伴う光量アンバランスの変化を防止で
きるようにするとともに高画質の静止面撮影を行えるよ
うにしたカメラを提供することを目的としている。

【0011】

【課題を解決するための手段】 上記の目的を達成するた
めに、本発明では、動画撮影と静止面撮影とを共通の撮
影光学系および撮像素子を用いて行うカメラにおいて、
撮影光学系の一部を構成する光学素子を光軸直交方向に
変位させて揺れ補正を行う際に、動画撮影時に撮像素子
により撮影するイメージサイズを、静止面撮影時のイメ
ージサイズよりも小さくするようにしている。

【0012】 すなわち、防振時に撮影するイメージサイ
ズを静止面撮影時より動画撮影時の方を小さくすること
で、防振に伴って光量アンバランスが生じ易い周辺部よ
り内側の撮像素子で動画撮影を行うことが可能とな
り、周辺光量のアンバランスを動画撮影時に目立たない
ようにすることが可能となる。したがって、撮影光学系
を大型にすることなく動画撮影でも十分な防振を行うこ
とが可能となる。

【0013】 なお、静止面撮影は瞬間を撮影するもので
あり、もともと周辺光量のアンバランスの許容範囲が動
画撮影より広いので、イメージサイズを大きくしても防
振時に生じる周辺光量のアンバランスは目立たない。

【0014】 しかも、静止面撮影のイメージサイズを大
きくすることで、CCDやCMOS等の微小な受光素子
の繰り返し配列を有する撮像素子を用いる場合に、静止
面撮影時の画素数を動画撮影時よりも多くすることがで
き、静止面画像の画質を向上させることも可能である。

【0015】 また、撮影光学系の焦点距離が同じである
場合に、静止面撮影時における最大絞りのFナンバーを
動画撮影時における最大絞りのFナンバーよりも大きく
設定することにより、静止面撮影時に最大絞りで撮影す
るとききの防振時の周辺光量のアンバランスを改善するこ

とも可能となる。

【0016】

【発明の実施の形態】図1には、本発明の実施形態であるカメラの構成を示している。また、図2、図3および図4には、上記カメラに用いる撮影レンズの光学実施例の断面図と収差図を示している。さらに、図5には上記カメラにおいて、撮影レンズの焦点距離と、焦点距離ごとに設定される最大絞りのFno.との関係を示している。また、図6には、上記カメラにおける撮影レンズのイメーサイズを示しており、図7には、無収差の理想レンズのFno.による性能の理論的特性を示している。また、図8には、上記カメラの動作シーケンスを表すフローチャートを示している。

【0017】図1において、1はズーム撮影レンズ系（撮影光学系）であり、2は、撮影レンズ系1を構成する一組のレンズであって、光軸直交方向に変位して防振（いわゆる手振れ補正）を行う振れ補正レンズである。【0018】3は撮像素子であり、セルピッチ（画素配置ピッチ）が3ミクロン程度のCCDまたはCMOS等の固体撮像素子が用いられている。

【0019】また、4は動画撮影（動画モード）と静止画撮影（静止画モード）とを切り換えるためのモード切換えスイッチである。本実施形態のカメラでは、動画撮影および静止画撮影のいずれも、共通の撮影レンズ系1と撮像素子3とを用いて行い、例えば、動画撮影を図1示のビデオテープ、DVD等の記録媒体に記録し、静止画情報をスティック状又はコンパクトメモリー素子やDVD等の記録媒体に記録する。

【0020】9は本カメラの動作全体の制御を司るカメラ制御回路であり、5はカメラ制御回路9からの指令信号に応じて撮影レンズ系1のズーム駆動制御を行うズーム制御回路である。

【0021】6はカメラ制御回路9からの指令信号に応じて振れ補正レンズ2のソフト駆動制御を行う防振制御回路であり、7はカメラ制御回路9からの指令信号に応じて絞りS.P.の駆動制御を行う絞り制御回路である。なお、本実施形態では、絞りS.P.の制御によって、所定のFno.が得られるようになっている。

【0022】8はカメラ制御回路9からの指令信号に応じて撮像素子3上における撮像エリア（イメーサイズ）の切り換え制御を行う撮像エリア制御回路である。【0023】次に、図2のフローチャートに従って本カメラ（主としてカメラ制御回路9）の動作を説明する。まず、不図示のメインスイッチが投入されて電源が投入され、本カメラがスタートすると、ステップ（図でSと略す）1にて、モード切換えスイッチ4の狀態を確認し、本カメラが動画モードか静止画モードかを判別する。

【0024】動画モードであるときは、ステップ2に進み、撮像エリア制御回路8を通じて、図6に示し撮像素

【0034】また、ステップ12では、静止画モードにおける焦点距離に対する最大絞りのFno.を、図5に示す静止画撮影時の曲線s上に制御するように設定する。本実施形態では、静止画モードにおける最大絞りのFno.は、焦点距離に応じて1.83～2.88の範囲で変化することになる。

【0035】つまり、本実施形態では、焦点距離fsw～ftの範囲において、動画撮影時と静止画撮影時とでは、焦点距離が同じである場合の最大絞りのFno.は、静止画撮影時の方が大きくなるように、すなわち同じ焦点距離に対して静止画撮影時は動画撮影時よりも開放Fno.が暗くなるように設定される。なお、本実施形態では、特に望遠側において動画撮影時より静止画撮影時の方が開放Fno.がより暗くなるように設定される。さらに、ステップ13では、静止画モードにおける最大絞りのFno.を、動画撮影モードよりも明るい静止画時最小絞り（例えば、F8）に設定する。つまり、静止画モードでは、動画モード時に絞り込み可能なFno.（例えば、F11）まで絞りを暗くすることができないようにする。

【0036】ここで、F8～11の範囲では、Fナンバールーを大きくすることによって軸上付近での光学的解像性の幾何光学収差低減要因による性能向上よりも回折現象の物理光学的要因による性能低下が大きくなる。このため、この範囲で静止画撮影時における最小絞りのFナンバールーが動画撮影時における最小絞りのFナンバールーよりも小さくなるように設定されている。

【0037】こうした本実施形態では、ステップ14において、ステップ12にて設定された最大絞りのFno.と、ステップ13にて設定された最小絞りのFno.との間で静止画モードでの絞りS.P.の制御を行う。

【0038】ここで、上記ステップ14では、静止画モードにおいて上記最大絞りおよび最小絞りとの間で絞り制御を行うが、この絞りにより性能向上による光量調節を補うために、低調度被写体に対しては低減シャッターもしくはストロボ（図示せず）で光量不足を補うのが望ましい。【0039】また、静止画撮影時の最小絞りを、動画撮影時の最小絞りより小さく（明るく）設定したことを伴い、高調度被写体に対して光量オーバーとなることを回避するために動画素子3側での高速電子シャッターや撮像レンズ系1内での高速シャッターにより対応するのが望ましい。

【0040】そして、ステップ15では、前述したステップ7と同様の光学的防振制御を繰り返す。

【0041】以上説明したように、本実施形態によれば、撮影レンズ系1の同じ焦点距離に対して静止画撮影時は動画撮影時よりも開放Fナンバールーが暗くなるように設定されるので、明るい動画撮影を行うことができ、一方で、静止画撮影時に撮影光学系の収差収差、色収差、組み立て偏心誤差等による光学性能低下を抑えることが

できる。したがって、小型の撮影レンズ系1において収差等を良好に補正することができ、動画像処理の負担が軽かつ明るい動画撮影と画質の静止画撮影とが可能になる。カメラを実現することができる。

【0042】なお、本実施形態では、最大絞りのFno.を、図5に示す曲線dと曲線sのように、動画撮影と静止画撮影とで完全に異なる（双方の曲線が交わることはない）特性となるように制御する場合について説明したが、焦点距離ftの状態で動画撮影時の最大絞りのFno.を、静止画撮影時の最大絞りのFno.より小さく設定することが静止画の画質性能を良好にするために特に重要である。このため、動画撮影時に、焦点距離fswの状態で動画撮影時の最大絞りのFno.が静止画撮影時の最大絞りのFno.に一致する曲線d'を用いるようにしてもよい。

【0043】また、本実施形態では、撮像素子3上における静止画撮影時のイメーサイズを動画撮影時のイメーサイズよりも大きくすることによって、静止画撮影時の画素数を動画撮影時に比べて多くし、これにより静止画後の画質向上を図っているが、この場合に上述した静止画撮影時の開放Fナンバールーを暗くする制御を行うことにより、撮影レンズ系1を大型化させることなく静止画の周辺収差を良好に補正することが可能となり、より画質の動画撮影を行うことができる。

【0044】さらに、本実施形態では、静止画撮影時および動画撮影時の最小絞りのFno.を、絞りS.P.のFno.の可変範囲のうちF8～11程度の絞り域の範囲、すなわちFno.を大きくすることによって軸上付近での光学的性能の幾何光学収差低減要因による性能向上よりも回折現象の物理光学的要因による性能低下が大きくなる範囲で、静止画撮影時における最小絞りのFno.（F＝8）が動画撮影時における最小絞りのFno.（F＝11）よりも小さくなるように設定している。これにより、静止画撮影時の画質を動画撮影時の画質に比べてより良好にすることができる。

【0045】このことを図7を用いて具体的に説明する。図7は、無収差理想レンズのFno.によるコントラストの周波数特性を示したものであり、Fno.によって撮影レンズ系1の光学性能がどのように変化するかを表している。

【0046】この図において、Fno.をF8まで絞ると、3ミクロンピッチCCDのナイキスト空間周波数と、ア周波数の半分の周波数である80本相当で、ほぼコンラスが50％まで低下する。もともと収差を伴っている実際の撮影レンズ系1を使うと、よりコントラストが低下するので、画質の静止画を得るために本実施形態では静止画時にはF8より小絞りになしように制御している。

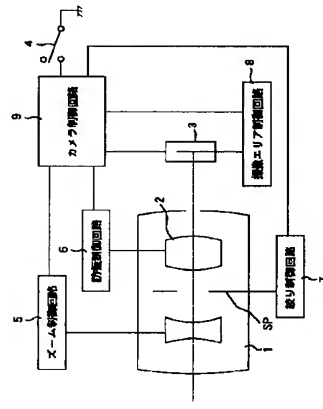
【0047】ここで、条件式（1）の中央項にFsmi
n＝8、λ＝0.588、P＝3を代入するとFsmi×

ートである。

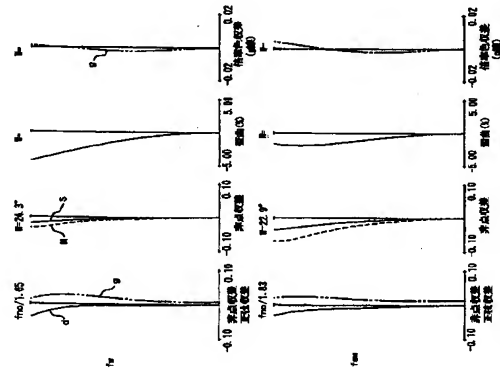
【符号の説明】

- 1 撮影レンズ系
- 2 振れ補正レンズ
- 3 撮像素子
- 4 モード切換えスイッチ
- 5 ズーム制御回路
- 6 防振制御回路
- 7 絞り制御回路
- 8 撮像エリア制御回路
- 9 カメラ制御回路
- SP 絞り
- FS フレアストップ

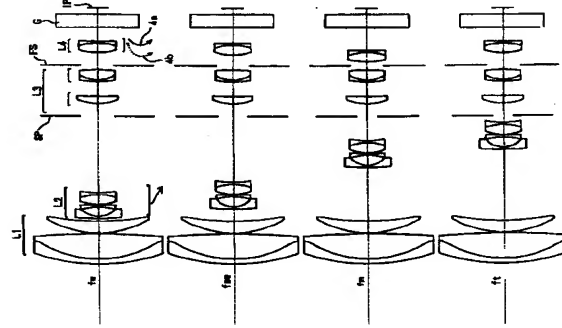
【図1】



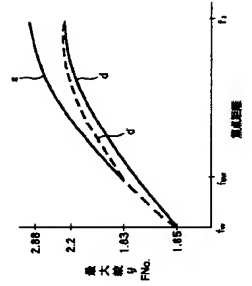
【図3】



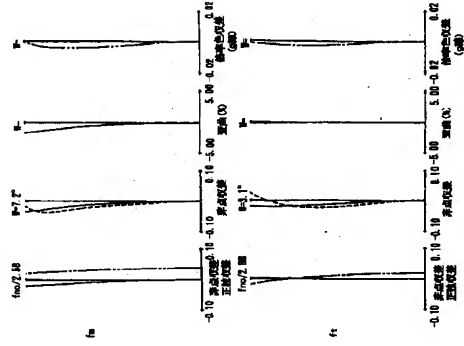
【図2】



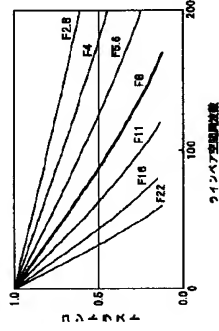
【図5】



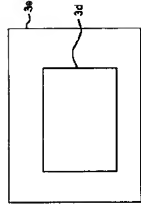
【図4】



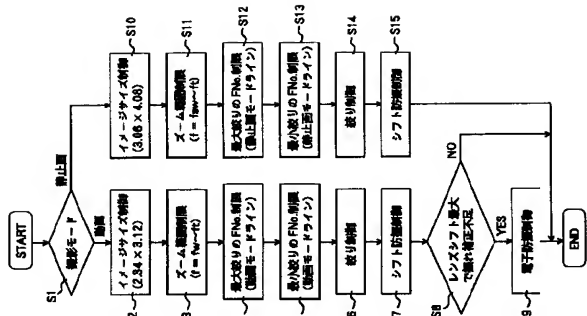
【図7】



【図6】



【図8】



【手続補正書】

【発出日】平成12年12月14日(2000.12.14)

【手続補正1】

【補正対象書類名】明細書

【補正対象項目名】0060

【補正方法】変更

【補正内容】

【数1】

$$X = \frac{F^2/R}{1 + (1 + F^2/R^2) \cdot \Delta F^2 + \Delta F^2 \cdot \Delta F^2 + \Delta F^2 \cdot \Delta F^2}$$